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VARIATION IN COCONUTS WITH PARTICULAR REFERENCE TO FRUIT PRODUCTION.

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THE selection of seed nuts is probably of greater importance in the case of coconuts than of any other crop grown on plantation lines when due consideration is given to the length of the profitable life of the palms which under good conditions should certainly exceed fifty years, and yet little real attention is given to the question when land is being opened for coconut cultivation.

The term "selected" as regards seed coconuts is misapplied to a very large extent at present, the methods of selecting them being far from scientific and rarely being based on a thorough examination of the individual tree. The commonest method of selection is that of purchasing seed nuts from a well established estate which is known to produce a fair quantity of copra per acre. This method is tolerably sound in the absence of reliable tree data as long as the trees from which the nuts are divided are growing in soil conditions similar to those existing on the area where it is desired to establish a new plantation, but merely ensures the production of trees of average utility. A vast improvement on this method is that of examining the trees in the field and marking as parents the individual trees which show desirable characters or which closely approximate to an approved type. This method, if thoroughly performed, should result in a more uniform plantation than the more casual method which is usually adopted, though complete uniformity cannot be obtained because trees which appear very much alike, differ not only constitutionally but seedlings from the same parent tree may be found to vary to an extent as yet undetermined, on account of cross-pollination which undoubtedly takes place though by no means to the exclusion of self-pollination as contemporaries maintain elsewhere. There are, in fact, many single coconut palms in Malaya isolated by several miles of jungle on which numerous fruits of all ages can always be seen, in spite of the depredations of monkeys. Instances may be seen in the lowlands on the Jerantut-Kuantan Road, at Jor at an elevation of 2,000 feet and at several other places.

For practical guidance in the matter of selecting parent trees by inspection in the field, the planter could not do better than study the lines indicated by Sampson (1) who investigated this important question very thoroughly, but who maintains that a detailed cropping register of each tree is the ideal. A practical method for establishing a register of this nature is described in the *Malayan Agricultural Journal* (2), and this paper is based on the results obtained by the maintenance of systematic records extending over four years.

In coconut cultivation, variation is well known to occur in many characters of which some, such as colour, size and shape of fruit are readily apparent, while other characters can only be revealed by careful investigations covering an extended period. In the latter category can be included seasonal variation in cropping, variation in root formation, variation in female flower production, and in the production of mature fruits per palm, variation in size and shape of nut, in thickness of meat, in oil content of the meat, in the rate of germination of seed nuts from different palms of the same variety, and in other characters.

A perusal of the annual exports of copra from the Federated Malay States (3) clearly reveals the seasonal vagaries of cropping. For instance, the exports in 1923, which was a bad coconut year climatically, were 824,028 pikuls as against 928,619 pikuls in 1922, despite the increased age of the coconut trees, additional young areas coming into bearing, the fact that the average price in 1923 was over 50 cents. per pikul higher than in 1922, and that the rubber market was still so dull. This represents a variation of over 12%.

Statistics collected from fifteen representative estates scattered over Malaya show an average decrease of over 11% in the yield of copra per acre in 1923 as compared with 1922, thus reflecting fairly closely the loss shown in the exports.

Such variation in cropping at times becomes a matter for concern to shippers of copra who reserve definite space for this product on their ships, and shortages sometimes mean loss unless other merchandise for export is abundant.

It is often claimed that coconut palms are periodic as regards their annual production of fruit but an examination of the figures of yield of ripe fruits per palm as shown in the Appendix disproves this and shows that the variation in yield is due to other causes of which climate, cultural operations and environment are the chief.

For the individual palm, variation in fruit production, under ordinary cultural conditions, must be largely climatic because good

and poor fruiting years for a mixed population argue against the tendency in the individual tree towards periodic fruiting. Annual variation in crops shows that fruiting has been determined by some extraneous circumstances which effect all the trees in a plantation alike, whereas if there was any innate tendency towards periodic fruiting it would be exhibited by different individuals in the same year, and consequently, in a plantation containing many palms, annual uniformity of production would result. This paper shows that uniform annual production is not achieved under normal conditions.

Sampson (1) who made a detailed study of the root systems of palms recorded wide variations in the number of roots formed per palm on palms growing under approximately the same conditions. For instance, an examination of the root systems of 6 palms of the same age, growing in the same field, showed a range of variation in the number of roots per palm from 1,460 to 2,405.

Similarly, variations in female flower production amongst palms of the same variety and age, growing side by side under ostensibly similar conditions, are pointed out by the same author, who traces them directly to physiological causes correlated with climatic changes. For instance, the number of female flowers per spathe on consecutive spathes of a single typical tree covering a two-year period were found to be 13, 12, 19, 14, 17, 27, 50, 17, 16, 15, 18, 17, 10, 9, 14, 18, 26, 14, 15, 14, 18. The single tree variation is still wider when the number of ripe fruits per spathe is considered.

In a mixed population of 102 palms approximately 10 years old, growing on excellent coastal land, the number of spathes, in situ per palm was found to vary from 2 to 18 with an average of 9, all the palms receiving as nearly as possible the same treatment in cultivation and drainage (4).

Within the same variety, even with adjacent trees subject to the same conditions of climate and cultivation and bearing fruits approximately equal in size, enormous variation in the size of the kernel is found, ranging from .4 to .6 of an inch as average limits, though under adverse conditions such as might be found where heavy and exhaustive cover crops like sweet potato or tapioca have been grown continuously, the meat is frequently much thinner, even being reduced to .2 inch or possibly less.

The oil content of the meat has also been found to vary greatly, local limits being from 52 to 80 per cent (5) and though much of this variation may be due to difference in ripeness of the nuts no doubt a fair amount of real variation exists. Preliminary experiments show a variation in the oil content of nuts grown on the same tree of 11 per cent.

There is also a wide variation in the amount of (toddy) obtainable from the treated flower stalks of different palms. Moreover the same palm will show a marked seasonal variation in sap production the flow being stimulated by fine weather, though prolonged drought is liable to retard it.

Rainy cloudy weather greatly retards sap flow. The quality of the sap, that is the amount of sucrose it contains, also varies with the age of the tree and the part of the spathe being tapped. Young palms do not yield such a rich juice as older ones, and the tips of the spathes produce sap which is not so rich as the sap produced by the middle or lower parts of the spathe.

The rate at which seed nuts of approximately equal maturity collected from different trees of the same variety germinate was found to vary greatly, the time taken by each group of 10 nuts from each of six trees to form shoots 1 foot long varying from 2 to 5½ months (6). In this instance, naturally, a certain proportion of the variation was due to differences in ripeness of the nuts despite the fact that the nuts were collected from trees which were systematically picked at regular intervals of 5 weeks for a period of four years by experienced coolies, but such differences could not possibly account for such widely differing rates of germination.

As to the causes of variation, climate, cultural operations and environment play a very great part but the hereditary characteristics of the tree must not be overlooked.

Variations in the shape, size and weight of fruits and of kernels borne by a single tree and which arise as modifications due to varying environmental conditions, particularly climate and cultural operations, may only be transitory and as such, these variations will be found to fluctuate about the "mean" or "mode" for each character provided that observations are maintained for a sufficiently long period, that fair cultivation is maintained and that the trees are not too old. On the other hand, despite environmental factors which vary in degree, each tree will retain its own individuality as long as conditions favour a fair degree of development.

In confirmation of this statement, it has been found, through the systematic records on which these notes are constructed, that in a mixed population of trees such as is found on any coconut estate, good producing trees on the average remain proportionately good yielders from year to year, while poor yielders continue to produce poorly. For instance, the annual fruit production of 15 trees, selected from the records to represent five good producers, five medium producers and

five poor producers, is fairly proportionate from year to year as may be seen from an examination of the following table :—

Row No.	Tree No.	Yield of ripe fruits per annum.				Average for 4 years.
		1920	1921	1922	1923	
1	5	102	117	98	78	99
6	5	98	103	100	113	104
10	3	140	129	91	122	121
11	17	89	105	118	108	105
14	10	135	119	114	91	115
1	7	42	64	63	64	58
2	12	48	67	66	75	64
4	5	60	69	62	64	64
7	4	64	86	51	80	70
8	4	68	78	74	74	72
6	18	16	24	22	22	21
7	15	22	29	37	37	31
10	8	20	23	28	32	26
11	20	14	26	27	22	22
18	21	32	27	24	26	27

Of course, the records do not cover a sufficiently long period to render the figures absolutely reliable but their comparative uniformity would definitely indicate that the ability to fruit, apart from seasonal variation, is an hereditary character.

It may be argued that different trees vary widely in the rate at which they come to maturity and assuming this to be true, that the records were initiated when the trees were too young being just under 10 years old. Against this, however, most planters in Malaya will agree that coconut trees under good average conditions, while they may not have reached their full bearing stage at 10-14 years old, are certainly not very remote from it. In any case this argument in itself is a confirmation of the tree's individuality.

A summary of the records on which this study of variation in fruit production is based is shown in the Appendix. The fruit was collected 89 times, or once every 5 weeks, between 1.6.1920 and 31.5.1924 a period of 4 full years, from a local coconut estate (Jugra Lands and Carey United, Division I) of fair average productive capacity as may be gauged from the following figures of copra production per acre per annum from the field in which the records were compiled (the full year ended in April in each case).

Year.	Pikuls.
1915	... 3.21
1916	... 7.31
1917	... 8.88
1918	... 9.77
1919	... 11.74
1920	... 14.46
1921	... 13.35
1922	... 9.30
1923	... 12.97

A block of 480 trees growing in twenty consecutive rows, each row containing twenty-four trees, was chosen as being fairly representative of the conditions on the estate, and each tree was labelled with its row and tree number.

In June 1920, the average age of the trees was just under 10 years and all the trees were planted 30 x 30 feet apart. The estate is well drained, the block under experiment being surrounded on all sides by a drain four feet deep and six feet wide at the top and intersected by two subsidiary drains four-and-a-half feet wide by three feet deep which divide the block into four equal-sized areas. One subsidiary drain runs between rows 10 and 11 and the second cuts it at right angles between the 12th and 13th trees of each row.

The soil consists of a rather stiff alluvial clay loam somewhat on the heavy side for coconut cultivation, but to all appearances very uniform in texture throughout the block. Primarily, the estate was clean-weeded but midway through the four-year period, a cover crop of *Centrosema plumieri* was sown and slowly established itself affording a fair cover by the end of the third year. At each 5-weekly picking, experienced coolies cut down all the ripe fruits from each tree and piled them near its base ready for counting and recording which was always carefully done.

The ripe fruits were cut by means of a curved knife attached to the end of a long bamboo, as in the majority of the trees the fruit was borne at an average height of 42 feet.

The rainfall during the 4 years averaged 95.89 inches per annum and with the exception of July, (which was dry, except in 1922,) was fairly uniformly distributed throughout each year.

Though some of the trees are known to have been supplies, with the exception of five very young palms which have not yet commenced to bear fruit and which have been eliminated from the records, all the trees appear approximately to be of the same age. Thus, omitting the five very young trees just mentioned, this study is based on records collected from a typical population of 475 palms of approximately the same age, growing under apparently uniform conditions.

VARIATION IN NUMBER OF RIPE FRUITS PER PICKING
PER PALM.

The table below indicates the classes and frequencies tabulated from Column 9 of the Appendix—the average number of nuts per picking per palm over the entire period of four years.

Class.	Frequency.	Product—C x F.
1	10	10
2	28	56
3	35	105
4	54	216
5	91	455
6	79	474
7	76	532
8	49	392
9	36	324
10	9	90
11	6	66
12	2	24
N = 475		2,744
$\text{Mean} = \frac{2,744}{475} = 5.776 \text{ or say } 6 \text{ fruits.}$		

The calculation shows a mean production per picking per palm of six fruits and a range of variation of from 1 to 12 fruits. Though pickings occurred every five weeks, in some cases the collection involved more than a single spathe per picking, but probably in 80% of the pickings, judging by inspection (no definite record was kept), fruits were only cut from a single spathe at each picking. The greatest number of fruits collected at any single picking was 30 from Tree No. 5 of Row No. 6., which gave an average per picking over the 4 years of 11 fruits. The highest average number of fruits collected per picking was 12 from two trees—Tree No. 3 of Row No. 10 averaging 12.4 and Tree No. 10 of Row No. 14 averaging 11.8 (say 12) fruits. The number of occasions when a single tree yielded no fruit per picking was 868 or 3.8% of the total number of counts (22,425 counts). Of this number 24 palms which produced 10 or less than 10 fruits per palm in the first year of the records account for 191 or 22% of the occasions. Eighteen of these twenty-four palms on examination were found to possess a close habit of branching, the fronds never expanding but maintaining a more or less upright position though they enjoyed their fair share of sunlight, were not overtopped by neighbouring palms and five of them were favourably situated beside drains. This upward branching habit is apparently distinctly correlated with poor yielding ability in coconuts for none of the eighteen palms displaying this habit produced a crop per annum in

any year under consideration which could be classed as better than poor, with the exception of palm No. 2 of row No. 3 which produced 60 nuts in 1923 and of palm No. 17 of Row No. 9 which produced 78 nuts in 1922, though it only averaged 37 nuts per annum over the 4 years. The high yield of this tree in 1922 was probably due to wound stimulation at the base of the trunk for it has been found that wounding at the collar stimulates fruit production on poor trees and this particular tree was noticeably wounded in that region in 1921. Of the other six palms, one was deformed and one showed an inherent tendency to nut-fall as, though it produced plenty of female flowers and young fruits were always apparent, a very large percentage of the fruits always dropped before maturity or before they could be used for copra production. Four palms were badly shaded and over-topped.

The following table shows the yields per annum of the twenty-four palms to which reference has been made, together with notes of habit or other cause of poor yield. The first six trees in the table were favourably situated beside drains.

Row No.	Tree No.	No. of times no fruits were obtained.	Yield of fruits in 1920.	Average yield per annum over 4 years.	Notes on Habits, &c.
1	13	4	3	20	Nut-fall
10	1	3	3	17	Up-branching
10	14	4	1	18	Over-shaded
10	20	11	9	18	"
11	5	3	7	20	"
20	1	6	10	29	Up-branching
2	3	3	10	22	"
2	5	3	7	20	"
2	11	5	8	13	"
3	2	2	9	36	"
3	9	8	9	17	"
3	11	11	10	13	"
3	16	8	0	20	"
4	23	22	1	5	Deformed
5	15	16	4	8	Up-branching
5	19	14	0	7	"
6	15	16	1	6	"
6	16	2	6	27	"
8	24	13	0	6	"
9	16	3	6	26	Bent & shaded
9	17	2	8	37	Up-branching
13	14	3	8	24	"
14	4	16	4	13	"
18	16	13	4	9	"
24 trees		191	—	431	—
Mean yield per annum per palm = $\frac{431}{24}$ = 17.96 — say 18 fruits.					

VARIATION IN RATE OF REACHING MATURITY.

The following table shows the mean yield of ripe fruits per palm per annum for the entire population of 475 palms contrasted with the actual production obtained from a number of individual palms from the same population.

Mean of 475 palms.		1920	1921	1922	1923
		42	65	59	60
Actual Yield.					
Row No.	Tree No.				
3	2	9	31	42	77
5	6	42	82	89	92
7	3	27	71	59	46
9	16	6	28	34	37
13	14	8	26	29	31
14	5	14	34	35	36
15	9	18	48	49	48
17	17	17	109	91	89
18	3	16	31	43	46
19	6	13	23	36	39
20	20	20	49	51	48

This table show that in 1920 some of the palms included in the entire population had not yet reached their normal full bearing stage under the conditions existing on the area, whereas the majority of the palms had, thus proving that individul palms vary in the age at which they reach maturity although field observations reveal no differences in growth. On flat alluvial land in this country, it is commonly noticed that young palms, usually about 10 years old, which have been yielding fairly well for 2-3 years, sustain a setback and produce poorly for 1-2 years before again yielding good crops. This habit is possibly an environmental effect resulting from a high water table which probably arrests the development of the natural root system temporally, causing a shock which retards growth for a time. The habit is, however, also recorded on estates which maintain a fairly low water table (four feet or more) so that it may be merely a growth character, marking the period, after which palms may be said to be mature.

VARIATION IN "COPRA" PER NUT.

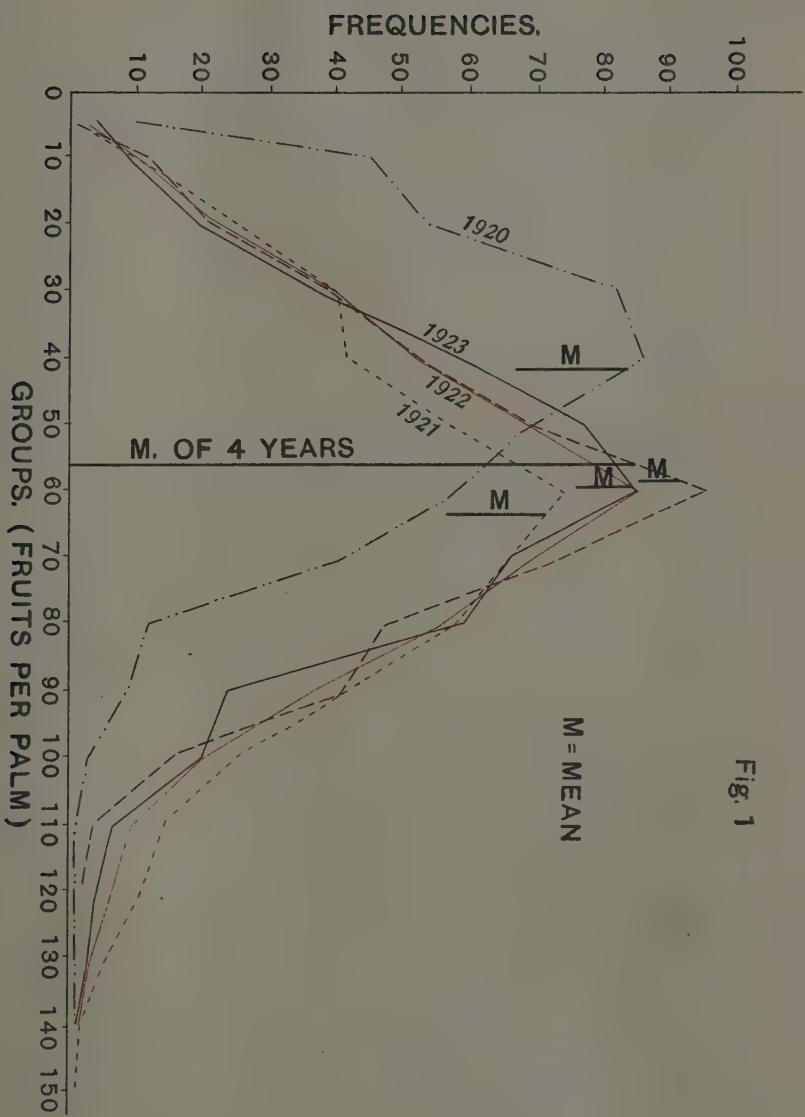
Experiments are in operation to trace the variation in the amount of copra produced per nut from nuts on the same palm and the variation of copra per nut from different palms, but the number of records yet obtained is insufficient to allow of forming definite conclusions. The variations for seventeen trees have been recorded,

however, and will indicate the tendency towards variation and its range. The amount of copra per nut per palm has been determined by weighing the copra obtained from each individual nut, using only ripe nuts, showing no germination "apple" and not less than 12 nuts to represent each palm. The amount of moisture in the copra of each nut was also determined, and averaged 8 per cent. The variation in the amount of copra per nut from palm No. 4, (to give an example,) using 15 nuts, was found to range from 234 to 275 grammes, the average being 255 grammes—a variation which might reasonably be due to slight differences in the maturity of the individual nuts. Comparing the average weight of copra per nut (average of 12 nuts) from 17 different palms, a range of variation of from 211 to 270 grammes was recorded. This range is sufficient to indicate that the amount of copra per nut varies with different palms. It also discloses the great economic possibilities of selecting the most productive palms as seed producers for future plantings.

VARIATION IN FRUIT PRODUCTION PER PALM.

The following frequency tables show the range of variation in fruit production per palm, the average production per palm for the entire population and the coefficient of variability of population, in each year.

Fig. 1



Frequency Table 1920.

Group.	F.	F × G.	d.	d ² .	Fd ² .
5	12	60	37	1,369	16,428
10	45	450	32	1,024	46,080
20	54	1,080	22	484	26,136
30	82	2,460	12	144	11,808
40	86	3,440	2	4	844
50	69	3,450	8	64	4,416
60	58	3,480	18	324	18,792
70	42	2,940	28	784	32,928
80	12	960	38	1,444	17,328
90	9	810	48	2,304	20,736
100	3	300	58	3,364	10,092
110	1	110	68	4,624	4,624
120	0	0	—	—	—
130	1	130	88	7,744	7,744
140	1	140	98	9,604	9,604
N = 475		FG = 19,810		fd ² = 227,060	
$M = \frac{19,810}{475} = 41.7 \text{ say } 42.$					

$$\text{Standard Deviation} = \sqrt{\frac{fd^2}{N}} = \sqrt{\frac{227,060}{475}}$$

$$= \sqrt{478.002}$$

$$= 21.863 \text{ fruits.}$$

$$\text{Coefficient of Variability} = \frac{\text{S.D.} \times 100}{M} = \frac{21.863 \times 100}{42} = 52.055$$

Frequency Table 1921.

Group.	F.	F × G.	d.	d ²	Fd ² .
5	1	5	59	4,481	3,481
10	10	100	54	2,916	29,160
20	25	500	44	1,636	48,400
30	40	1,200	34	1,156	46,240
40	42	1,680	24	576	24,192
50	57	2,850	14	196	11,172
60	74	4,440	4	16	1,184
70	66	4,620	6	36	2,376
80	58	4,640	16	256	14,848
90	42	3,780	26	676	28,392
100	25	2,500	36	1,296	32,400
110	15	1,650	46	2,116	31,740
120	11	1,320	56	3,136	34,496
130	6	780	66	4,356	26,136
140	2	280	76	5,776	11,552
150	1	150	86	7,396	7,396
N = 475		30,495		fd ² = 353,165	
$M = \frac{30,495}{475} = 64.2 \text{ say } 64.$					

$$\text{Standard Deviation} = \sqrt{\frac{353,165}{475}}$$

$$= \sqrt{743.5}$$

$$= 27.27 \text{ fruits}$$

$$\text{Coefficient of Variability} = \frac{27.27 \times 100}{64} = 42.609$$

Frequency Table 1922.

Group.	F.	G. × F.	d.	d ² .	Fd ² .
5	1	5	54	2,916	2,916
10	12	120	49	2,401	28,812
20	21	420	38	1,444	30,324
30	39	1,170	29	841	32,791
40	53	2,120	19	361	19,133
50	69	3,450	9	81	5,589
60	95	5,700	1	1	95
70	74	5,180	11	121	8,954
80	48	3,840	21	441	21,168
90	41	3,690	31	961	39,401
100	16	1,600	41	1,681	26,896
110	4	440	51	2,601	10,404
120	2	240	61	3,721	7,442
N = 475		FG = 27,975	fd ² = 233,925		
$M = \frac{27,975}{475} = 58.8 \text{ say } 59.$					

Standard Deviation

$$= \sqrt{\frac{233,925}{475}}$$

$$= \sqrt{492.474}$$

$$= 22.19 \text{ fruits}$$

Coefficient of Variability

$$= \frac{22.19 \times 100}{59} = 37.610$$

Frequency Table 1923.

Group.	F.	F. × G.	d.	d ² .	Fd ² .
5	4	20	54	2,916	11,564
10	9	90	49	2,401	21,609
20	20	400	39	1,521	30,420
30	37	1,110	29	841	31,117
40	59	2,360	19	361	21,299
50	77	3,850	9	81	6,237
60	85	5,100	1	1	85
70	66	4,620	11	121	7,986
80	59	4,720	21	441	26,019
90	24	2,160	31	961	23,064
100	20	2,000	41	1,681	33,620
110	7	770	51	2,601	18,207
120	4	480	61	3,721	14,884
130	3	390	71	5,041	15,123
140	1	140	81	6,561	6,561
N = 475		FG = 28,210		fd ² = 267,895	
$M = \frac{28,210}{475} = 59.29 \text{ say } 59.$					

$$\text{Standard Deviation} = \sqrt{\frac{267,895}{475}}$$

$$= \sqrt{563.989}$$

$$= 23.75 \text{ fruits.}$$

$$\text{Co-efficient of Variability} = \frac{23.75 \times 100}{59} = 40.254$$

Frequency Table, Average of 4 years.

This table shows the group frequencies of the average production per palm per annum over the entire four year period.

Group.	F.	F. × G.	d.	d ² .	F.d ² .
5	1	5	51	2,601	2,601
10	10	100	46	2,116	21,160
20	27	540	36	1,296	34,992
30	39	1,170	26	676	26,364
40	63	2,520	16	256	16,128
50	98	4,900	6	36	3,528
60	74	4,440	4	16	1,184
70	74	5,180	14	196	14,504
80	45	3,600	24	576	25,920
90	32	2,880	34	1,156	36,992
100	7	700	44	1,936	13,552
110	4	440	54	2,916	11,664
120	1	120	64	4,096	4,096
N = 475		ΣFG=26,595		Σ F.d ² = 212,685	
$M = \frac{26,595}{475} = 55.99 \text{ say } 56.$					

$$\text{Standard Deviation} = \frac{\sqrt{E.F.d^2.}}{N.}$$

$$= \frac{\sqrt{212,685}}{475}$$

$$= \sqrt{447.75}$$

$$= 21.16$$

$$\text{Co-efficient of Variability} = \frac{\text{S.D.} \times 100}{M} = \frac{21.16 \times 100}{56} = 37.79.$$

The above tables are summarised below and graphically represented in Fig. I. in which the general uniformity of the frequency curves in each year is apparent.

SUMMARY.					
1920 Coeff. of variability - 52.055			Mean yield per palm - 42		
1921	„	„ - 42.609	„	„	- 64
1922	„	„ - 37.610	„	„	- 59
1923	„	„ - 40.254	„	„	- 59
Average	„	„ - 37.79	„	„	- 56 (4 yrs.)

The Summary and the curves show that 1920 was the poorest yielding year under observation, the average yield per palm from the whole population being only 42 fruits.

This low mean yield is, however, partly accounted for by the fact that approximately 25 per cent (by inspection of records) of the population of palms had not yet entered their period of full maturity, as shown by the figures of annual yield compared with average yield per palm of the population during the year. The same reason would account for the high coefficient of variability in this year. The year 1921 was by far the best yielding period because it was a good one climatically and all the palms appeared to have reached maturity.

The coefficient of variability was, however, a shade above the average for the entire period, probably due to the fact that exceptionally good season forced fruit production to more than average limits.

The year 1922 was normal for the conditions existing on the experimental area and the coefficient of variability approximated that of the average of the entire four-year period.

In 1923, despite the increased age of the palms, the average—yield per palm was inappreciably greater than in the previous year: moreover, the coefficient of variability was higher than the average both results apparently being due to the less favourable season as compared with 1922.

A perusal of the last frequency table, which gives the average of four years, shows that, for a mixed population of palms growing under fair average conditions on the flat coastal lands of the Peninsula, any individual palm may be found to vary in fruit production by as much as 37.79 per cent from the mean of the population. The table also shows, assuming thirty five nuts per palms per annum as the lowest rate of economic production, that 77 palms or 16 per

cent are below utility standard. Many planters prefer to reckon forty nuts per palm as the minimum rate of profitable production per annum and at this rate 109 palms or 23 per cent of the population consists of unprofitable individuals which produce only 11.6 per cent of the crop, assuming that half the palms in the "40" group produce 40 or less than 40 nuts. If palms which produce less than forty nuts per annum are regarded as uneconomic, and if better yields cannot be induced by practical methods (improved cultivation, manuring, tapping, etc.) then such palms had better be destroyed and replaced by palms grown from selected seed.

The chief feature of the frequency curves in Fig. I. is their skewness on the positive side showing that the population contains many palms which produce more fruit than the average. The red curve shows the average for the population over the three years 1921, 1922 & 1923, omitting 1920 when the number of immature palms greatly affected the group frequencies.

Period 1921, 1922, 1923. Mean = 60 nuts.

Group.	Frequency.	Group.	Frequency.	Group.	Frequency.
5	2	50	68	100	20
10	10	60	85	110	9
20	22	70	69	120	6
30	39	80	55	130	3
40	51	90	36	140	1

The calculated mean yield for the period 1921, 1922, 1923, is 60 nuts per palm per annum and the red curve shows that 36 palms or approximately 8 per cent of the population yielded crops 50 per cent above the mean for the period. This curve also shows that 14 palms produced 75 per cent more fruits than the average while 6 palms yielded 100 per cent above the average for this three-year period.

The large variability which exists and the wide range of fruit production per palm indicated by the group classes in the frequency tables (5 to 150 nuts) show that the coconut crop offers abundant scope for the selection of heavy yielding palms, provided that the copra derived from the nuts (and its oil content) is combined with the quantity of fruits produced in making selections.

Similar records were maintained for four years on a smaller number of palms in Province Wellesley on Batu Kawan Estate, where coconut growing conditions are better than on Carey Island judging by the larger yields of nuts which the records show. This block of fifty palms shows a mean yield per palm per annum over the four-year period of 98 fruits, one palm having the outstanding average yield of 183 fruits per annum, the nuts being medium to smallish in size and containing good thick copra.

This block, which is planted with palms two years older than those on Carey Island and only contains fifty palms, shows a co-efficient of variability in fruiting over four years of 26 as compared with 37.79 for the larger block on Carey Island.

Practical use is being made of these yield records for a fifty-acre block of alluvial well-drained land has been cleared and planted up with progeny rows from the best yielding palms as shown by the records and from several other selected parents growing under dissimilar conditions.

Each progeny row contains twenty-five palms derived from seed-nuts of the same selected parent palm and there are eighty-four progeny rows.

These progeny rows form the basis for further selection when their fruiting capabilities have been tested and for intensive genetic research.

CONCLUSION.

The existence of variation in several characters of the coconut palm has long been recognised, but definite statistical proof of the degree of variation has been very scant. This paper shows definitely that there is a wide range of variation in fruit production per palm. The disposition of the palms from which the records were collected would indicate that the variation was not due to varying soil conditions, for good and poor producing palms stand side by side with great frequency; moreover, alluvial clay soils are notable locally for their general uniformity. Variation in other characters is also indicated.

The frequency curves show the variation in production graphically, and their inspection demonstrates the need for selection in this important branch of tropical agriculture, although results can only be obtained after many years of patient work.

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CAREY ISLAND.

SUMMARY OF COCONUT FIGURES.

Appendix.

29.5.20-4.4.20. 18.5.21-24.4.22. 20.6.22-8.5.23. 9.6.23-30.5.24.

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
1	1	35	51	64	49	199	50	5
	2	64	82	68	75	289	72	7
	3	64	48	88	61	261	65	7
	4	56	83	91	66	296	74	8
	5	102	117	98	78	395	99	10
	6	46	70	83	60	264	66	7
	7	42	64	63	64	233	58	6
	8	71	59	78	78	286	72	7
	9	72	76	89	82	319	80	8
	10	43	57	59	49	208	52	5
	11	23	77	57	50	207	52	5
	12	63	88	93	86	330	83	8
	13	3	23	30	22	78	20	2
	14	54	50	62	25	191	48	5
	15	5	19	24	40	88	22	2
	16	48	78	78	56	260	65	7
	17	41	65	46	58	210	53	5
	18	45	59	68	50	222	56	6
	19	14	23	24	31	92	23	2

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
1	20	67	48	62	53	230	58	6
	21	56	82	89	80	307	77	8
	22	46	63	73	42	224	56	6
	23	90	99	85	76	350	88	9
	24	53	82	68	50	253	63	6
2	1	38	44	62	69	213	53	5
	2	31	50	61	72	214	54	5
	3	10	29	27	20	86	22	2
	4	51	100	97	85	333	83	9
	5	7	22	28	22	79	20	2
	6	62	70	79	63	274	69	7
	7	35	32	45	37	149	37	4
	8	23	37	35	43	138	35	4
	9	77	77	57	68	279	70	7
	10	65	73	62	73	273	68	7
	11	8	16	17	11	52	13	1
	12	48	67	66	75	256	64	7
	13	28	60	54	61	203	51	5
	14	45	63	46	44	198	50	5
	15	30	38	43	44	155	39	4
	16	13	52	34	31	130	33	3
	17	51	82	72	82	287	72	7
	18	15	33	27	17	92	23	2
	19	21	92	59	78	250	63	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum	Average per picking over 4 years to nearest whole number.
2	20	46	91	76	72	285	71	7
	21	28	89	69	61	247	62	6
	22	15	79	69	62	225	56	6
	23	65	107	92	76	340	85	9
	24	24	39	46	47	156	39	4
3	1	92	54	52	37	175	44	4
	2	9	31	42	60	142	36	4
	3	29	36	41	26	132	33	3
	4	24	57	50	65	198	50	5
	5	15	14	16	16	61	15	2
	6	35	58	42	61	196	49	5
	7	53	72	58	61	244	61	6
	8	32	45	42	47	166	42	4
	9	9	18	16	24	67	17	2
	10	31	53	57	41	182	46	5
	11	10	18	6	16	50	13	1
	12	41	45	64	60	210	53	5
	13	41	104	87	97	329	82	8
	14	44	61	53	61	219	55	6
	15	13	29	18	22	82	21	2
	16	0	35	25	19	79	20	2
	17	39	45	75	39	198	50	5
	18	10	52	27	39	128	32	3
	19	69	104	78	91	342	86	9

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
3	20	47	42	55	54	198	50	5
	21	37	55	47	59	198	50	5
	22	64	72	78	81	290	73	7
	23	26	74	62	38	200	50	5
	24	33	64	57	51	205	51	5
4	1	17	32	29	31	109	28	3
	2	38	45	55	58	196	49	5
	3	21	51	43	52	167	42	4
	4	23	50	34	51	158	40	4
	5	60	69	62	64	255	64	7
	6	20	41	37	45	143	36	4
	7	45	97	62	54	258	65	7
	8	78	88	65	44	275	69	7
	9	108	94	84	85	371	93	10
	10	28	53	46	44	171	43	4
	11	37	65	53	51	206	52	5
	12	46	54	56	47	203	51	5
	13	16	58	44	63	181	45	5
	14	49	40	56	65	210	53	5
	15	52	66	57	75	250	63	6
	16	17	38	52	34	141	35	4
	17	30	79	60	66	235	59	6
	18	93	89	75	67	324	81	8
	19	37	71	74	79	261	65	7

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
4	20	56	77	72	100	305	76	8
	21	42	64	76	54	236	59	6
	22	56	75	53	72	256	64	7
	23	1	7	3	9	20	5	1
	24	44	60	54	36	194	49	5
5	1	33	73	72	58	236	59	6
	2	21	113	43	61	238	60	6
	3	30	62	58	64	214	54	5
	4	46	71	85	68	270	68	7
	5	22	18	57	10	107	27	3
	6	42	82	89	92	305	76	8
	7	35	30	53	37	155	39	4
	8	54	85	23	84	246	62	6
	9	76	65	67	65	233	58	6
	10	21	64	59	61	205	51	5
	11	54	99	66	109	328	82	8
	12	17	19	25	24	85	21	2
	13	45	65	64	81	235	59	6
	14	32	53	48	56	189	47	5
	15	4	13	13	3	33	8	1
	16	14	16	20	24	74	19	2
	17	26	31	24	82	163	41	4
	18	20	23	29	26	98	25	2
	19	0	12	11	5	28	7	1

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
5	20	92	68	92	100	352	88	9
	21	68	78	89	81	316	79	8
	22	31	59	87	71	248	62	6
	23	71	85	77	80	313	78	8
	24	32	46	33	33	154	39	4
6	1	30	48	54	55	182	46	5
	2	15	48	35	32	130	33	3
	3	52	78	61	59	250	63	6
	4	41	76	71	84	272	68	7
	5	98	103	100	113	414	104	11
	6	29	30	56	54	169	42	4
	7	51	45	65	65	226	57	6
	8	51	66	49	44	210	53	5
	9	43	101	95	89	328	82	8
	10	69	99	81	99	348	87	9
	11	58	72	57	67	254	64	7
	12	19	32	47	31	129	32	3
	13	41	85	96	90	312	78	8
	14	19	80	57	49	205	51	5
	15	1	7	12	5	25	6	1
	16	6	82	43	25	106	27	3
	17	33	66	41	35	175	44	4
	18	16	22	24	22	84	21	2
	19	56	64	59	56	235	59	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
6	20	21	60	40	47	168	42	4
	21	81	102	95	81	359	90	9
	22	48	44	42	40	174	44	4
	23	44	61	53	51	219	55	6
	24	45	54	72	50	221	55	6
7	1	34	56	43	58	191	48	5
	2	23	35	34	37	129	32	3
	3	27	71	59	46	203	51	5
	4	64	86	51	80	281	70	7
	5	33	40	55	44	172	43	4
	6	62	75	60	78	275	69	7
	7	30	38	36	82	186	47	5
	8	Young	Palm	...	...	...	...	...
	9	64	91	76	75	326	82	8
	10	83	103	106	83	375	94	10
	11	15	29	33	19	96	24	2
	12	50	70	75	66	261	65	7
	13	41	69	54	52	216	54	6
	14	31	24	37	35	127	32	3
	15	22	29	37	37	125	31	3
	16	20	30	27	26	103	26	3
	17	28	54	52	40	174	44	4
	18	22	125	48	48	243	61	6
	19	83	95	68	90	336	84	9

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
7	20	19	40	41	39	139	35	4
	21	70	105	89	85	349	87	9
	22	60	78	79	54	271	68	7
	23	52	83	96	61	292	73	7
	24	32	107	63	60	262	66	7
8	1	12	24	28	28	92	23	2
	2	42	48	43	59	192	48	5
	3	33	46	56	61	196	49	5
	4	63	78	74	74	289	72	7
	5	68	87	81	64	300	75	8
	6	44	78	83	74	279	70	7
	7	44	66	47	53	210	53	5
	8	30	95	72	73	270	68	7
	9	77	100	87	89	353	88	9
	10	58	68	63	66	255	64	7
	11	61	93	78	66	298	75	8
	12	15	27	36	30	108	27	3
	13	30	43	35	31	139	35	4
	14	33	54	57	46	190	48	5
	15	66	84	81	76	307	77	8
	16	17	38	42	28	125	31	3
	17	13	32	29	43	117	29	3
	18	24	25	45	30	124	31	3
	19	26	48	32	39	145	36	4

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
8	20	36	57	40	47	180	45	5
	21	44	80	62	43	229	57	6
	22	37	66	50	53	206	52	5
	23	34	71	35	35	175	44	4
	24	0	7	10	7	24	6	1
9	1	44	71	58	50	223	56	6
	2	36	7	48	65	156	39	4
	3	75	100	71	93	339	85	9
	4	35	65	51	59	210	53	5
	5	71	80	84	113	348	87	9
	6	55	109	78	65	307	77	8
	7	79	122	75	78	354	89	9
	8	62	79	77	76	294	74	8
	9	51	63	56	45	215	54	6
	10	50	74	47	67	238	59	6
	11	64	52	55	58	229	57	6
	12	48	73	65	62	248	62	6
	13	16	35	52	41	144	36	4
	14	58	91	74	72	295	74	8
	15	47	103	79	83	312	78	8
	16	6	28	34	37	105	26	3
	17	8	78	22	40	148	37	4
	18	70	111	88	85	354	88	9
	19	71	86	84	89	330	83	8

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
9	20	40	57	46	54	197	49	5
	21	65	89	66	85	305	76	8
	22	45	74	73	51	243	61	6
	23	24	54	29	46	153	38	4
	24	47	69	49	45	210	53	5
10	1	3	15	15	84	67	17	2
	2	32	37	50	53	172	43	4
	3	140	129	91	122	482	121	12
	4	61	95	88	103	347	87	9
	5	29	35	49	43	156	39	4
	6	51	87	74	73	285	71	7
	7	66	95	71	72	304	76	8
	8	20	23	28	32	103	26	3
	9	84	87	80	60	311	78	8
	10	63	65	71	52	251	63	6
	11	35	59	39	48	181	45	5
	12	56	63	65	76	260	65	7
	13	54	75	75	60	264	66	7
	14	1	15	23	33	72	18	2
	15	68	74	92	66	300	75	8
	16	54	72	85	76	287	72	7
	17	66	99	87	56	308	77	8
	18	14	78	49	62	203	51	5
	19	33	62	44	35	174	44	4

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
10	20	9	20	28	14	71	18	2
	21	48	57	63	60	228	57	6
	22	51	84	67	66	268	67	7
	23	42	38	66	34	180	45	5
	24	41	53	68	70	232	58	6
11	1	55	73	74	66	268	67	7
	2	40	48	30	60	178	45	5
	3	80	64	72	77	293	73	8
	4	29	59	59	57	204	51	5
	5	7	30	26	17	80	20	2
	6	75	96	89	103	363	91	9
	7	34	32	41	42	149	37	4
	8	59	93	70	80	302	76	8
	9	88	48	88	57	281	70	7
	10	89	90	99	74	352	88	9
	11	41	50	46	40	177	44	5
	12	26	181	49	117	323	81	8
	13	51	75	65	79	270	68	7
	14	36	56	44	57	193	48	5
	15	65	77	54	95	291	73	7
	16	13	30	6	45	94	24	2
	17	89	105	118	108	420	105	11
	18	47	128	69	132	376	94	10
	19	46	48	56	68	218	55	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
11	20	14	26	27	22	89	22	2
	21	34	93	68	89	284	71	7
	22	21	83	60	39	203	51	5
	23	72	145	53	82	352	88	9
	24	66	58	47	49	220	55	6
12	1	47	92	77	74	290	73	7
	2	101	75	92	99	367	92	9
	3	60	74	63	81	278	70	7
	4	40	62	49	58	209	52	5
	5	44	94	68	61	267	67	7
	6	25	49	45	33	152	38	4
	7	48	95	100	98	341	85	9
	8	70	107	74	77	328	82	8
	9	60	63	68	60	251	43	6
	10	36	47	55	61	199	50	5
	11	28	89	119	99	335	84	9
	12	48	79	71	60	258	47	7
	13	48	53	35	52	188	47	5
	14	81	117	76	103	377	94	10
	15	60	60	50	56	226	56	6
	16	12	24	22	27	85	21	2
	17	45	78	37	86	246	62	6
	18	63	63	56	66	248	62	6
	19	41	63	63	51	218	55	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
12	20	27	52	38	51	168	42	4
	21	33	63	43	58	197	49	5
	22	25	60	67	50	202	51	5
	23	49	92	77	50	218	55	6
	24	19	69	54	47	189	47	5
13	1	31	60	60	52	203	51	5
	2	72	107	88	86	353	88	9
	3	70	98	84	87	339	85	9
	4	57	104	89	111	361	90	9
	5	28	40	45	32	140	35	4
	6	34	59	35	60	188	47	5
	7	32	42	46	45	165	41	4
	8	17	35	29	29	110	28	3
	9	72	87	74	85	318	79	8
	10	32	17	74	60	183	46	5
	11	12	19	7	31	69	17	2
	12	67	107	81	99	354	89	9
	13	45	64	70	75	254	64	7
	14	8	26	29	31	94	24	2
	15	36	114	72	77	299	75	8
	16	33	40	59	55	187	47	5
	17	16	54	33	35	138	35	4
	18	32	45	40	56	173	43	4
	19	67	127	89	107	390	98	10

		Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Aver- age of 4 years per annum.	Average per picking over 4 years to nearest whole number.
13	20	48	88	66	66	268	67	7
	21	47	79	76	101	303	76	8
	22	56	94	73	67	290	72	7
	23	15	34	39	33	121	30	3
	24	44	49	41	31	165	41	4
14	1	68	80	76	71	295	74	8
	2	56	73	68	77	274	69	7
	3	24	73	59	77	233	58	6
	4	4	35	12	1	52	13	1
	5	14	34	35	36	119	30	3
	6	56	68	69	79	272	68	7
	7	64	74	61	69	268	67	7
	8	26	59	41	42	168	42	4
	9	66	74	78	73	291	73	7
	10	135	119	114	91	459	115	12
	11	12	36	23	44	115	29	3
	12	29	69	57	53	208	52	5
	13	63	74	75	66	278	69	7
	14	61	53	71	61	246	62	6
	15	19	38	49	17	123	31	3
	16	16	33	12	12	73	18	2
	17	47	96	71	82	296	74	7
	18	26	32	41	54	153	38	4
	19	13	36	61	89	199	50	5

Row.	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
14	20	13	25	11	7	56	14	1
	21	56	91	65	62	274	68	7
	22	68	97	81	46	292	73	7
	23	55	53	63	55	226	57	6
	24	44	77	54	48	223	56	6
15	1	29	84	59	38	210	53	5
	2	44	41	62	54	201	50	5
	3	51	59	60	86	206	52	5
	4	52	150	105	118	425	106	11
	5	54	72	57	69	252	63	6
	6	18	86	66	47	217	54	6
	7	34	55	69	61	219	55	6
	8	68	125	87	101	401	100	10
	9	18	48	49	48	163	41	4
	10	21	54	37	61	173	43	4
	11	37	51	61	69	218	55	6
	12	36	117	100	93	346	87	9
	13	20	34	30	46	130	33	3
	14	69	91	88	89	337	84	9
	15	56	68	57	81	257	64	7
	16	21	24	56	43	144	36	4
	17	14	59	36	48	157	39	4
	18	30	46	52	65	193	48	5
	19	48	32	77	63	220	55	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
15	20	45	65	54	56	220	55	6
	21	22	56	61	65	204	51	5
	22	40	83	84	80	287	72	7
	23	58	70	60	70	258	65	6
	24	45	38	56	53	192	48	5
16	1	41	69	68	66	244	61	6
	2	47	71	59	71	248	62	6
	3	36	67	54	41	198	50	5
	4	59	86	83	54	282	71	7
	5	56	114	98	126	394	99	10
	6	33	75	60	107	275	69	7
	7	36	39	47	54	176	44	5
	8	12	38	39	37	126	32	3
	9	50	92	65	96	303	76	8
	10	83	118	91	122	414	104	11
	11	56	74	61	82	273	68	7
	12	67	69	61	60	257	64	7
	13	75	113	66	104	358	90	9
	14	55	128	96	101	380	95	10
	15	33	52	51	46	182	46	5
	16	32	42	43	52	169	42	4
	17	71	65	61	96	293	74	8
	18	53	38	77	70	238	60	6
	19	53	117	77	86	333	82	9

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
16	20	35	56	61	42	194	49	5
	21	15	17	94	18	144	36	4
	22	86	90	98	74	348	87	9
	23	57	79	56	62	254	64	7
	24	40	64	53	64	221	55	6
17	1	53	95	47	63	258	65	7
	2	29	64	58	41	192	48	5
	3	59	81	91	82	313	78	8
	4	44	112	76	78	310	78	8
	5	Young Palm						
	6	74	96	88	89	347	87	9
	7	60	76	74	95	305	76	8
	8	77	56	45	62	240	60	6
	9	35	55	47	56	193	48	5
	10	Young Palm						
	11	39	59	94	77	269	67	7
	12	38	49	53	37	177	44	5
	13	65	145	37	52	299	75	8
	14	43	64	64	79	250	63	6
	15	55	94	76	66	291	73	7
	16	11	49	33	31	124	31	3
	17	17	109	91	89	306	77	8
	18	94	124	100	130	448	112	11
	19	44	68	88	50	250	63	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
17	20	55	123	108	79	365	91	9
	21	46	111	34	74	265	66	7
	22	42	56	102	67	267	67	7
	23	38	75	78	81	272	68	7
	24	43	68	63	65	239	60	6
18	1	31	59	65	64	219	55	6
	2	44	76	64	56	240	60	6
	3	16	31	48	46	136	34	8
	4	32	68	48	65	213	53	5
	5	61	102	94	96	363	91	9
	6	Young	Palm					
	7	74	85	90	83	332	83	9
	8	40	61	74	63	238	60	6
	9	52	78	98	77	305	76	8
	10	Young	Palm					
	11	47	53	58	61	219	55	6
	12	72	129	100	137	438	110	11
	13	64	90	76	69	299	74	8
	14	42	78	78	82	275	69	7
	15	50	82	73	92	297	74	8
	16	4	15	6	11	36	9	1
	17	35	88	94	75	292	73	7
	18	26	46	58	44	174	44	4
	19	15	73	46	55	189	48	5

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number
18	20	42	55	55	50	202	51	5
	21	32	27	24	26	109	27	3
	22	54	76	57	60	247	62	6
	23	41	92	71	74	278	69	7
	24	26	26	29	21	102	26	3
19	1	18	35	32	31	116	29	3
	2	72	78	75	72	297	74	8
	3	49	63	63	68	243	61	6
	4	74	73	78	84	309	77	8
	5	45	56	42	44	187	47	5
	6	13	23	36	39	111	28	3
	7	40	56	60	52	208	52	5
	8	24	37	44	52	157	39	4
	9	25	55	54	47	181	45	5
	10	90	57	92	99	338	85	9
	11	63	81	68	68	280	70	7
	12	43	73	73	57	246	62	6
	13	43	39	61	38	181	45	5
	14	72	69	71	86	298	75	8
	15	42	54	66	55	217	54	6
	16	58	74	84	62	278	70	7
	17	26	68	87	61	242	61	6
	18	57	62	81	52	252	63	6
	19	13	25	25	15	78	20	2

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
19	20	70	112	90	98	370	93	9
	21	29	55	38	45	167	42	4
	22	12	24	30	26	92	23	2
	23	46	76	58	59	239	60	6
	24	65	76	71	31	243	61	6
20	1	10	39	24	43	116	29	3
	2	51	82	84	75	192	73	7
	3	34	55	57	66	212	53	5
	4	44	59	49	72	224	56	6
	5	39	57	41	52	189	47	5
	6	75	83	112	95	365	91	9
	7	17	62	53	68	200	50	5
	8	28	5	67	45	145	36	4
	9	42	67	17	54	180	45	5
	10	54	80	79	68	281	70	7
	11	48	40	49	66	203	51	5
	12	24	48	59	45	176	44	5
	13	58	101	72	72	303	76	8
	14	20	64	51	62	197	49	5
	15	28	83	59	47	217	54	6
	16	13	31	30	45	119	30	3
	17	29	75	75	48	227	57	6
	18	45	78	74	80	277	69	7
	19	39	71	49	61	220	55	6

Row	Tree No.	Total 1st year.	Total 2nd year.	Total 3rd year.	Total 4th year.	Total yield for 4 years.	Average of 4 years per annum.	Average per picking over 4 years to nearest whole number.
20	20	20	49	51	48	168	42	4
	21	40	57	38	45	180	45	5
	22	41	48	41	35	165	41	4
	23	38	41	52	50	181	45	5
	24	28	43	22	43	136	34	3

Publications of the Department of Agriculture.

The following publications, except those out of print, may be obtained on application to the Office of the Secretary for Agriculture; and the Malay States Information Agency, 88, Cannon Street, E.C. London.

A remittance to cover the cost should accompany applications; otherwise the Journals will be sent by post, Cash on Delivery, where that system is in force.

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2. The Malayan Agricultural Journal (continuing the Agricultural Bulletin). Published monthly.

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3. The Handbook of Malayan Agriculture, price \$1.00.

Current numbers of the Malayan Agricultural Journal and the Handbook may be purchased at the Railway Bookstalls and Branches of Messrs. The Federal Rubber Stamp Co.

4. Special Bulletins.

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2. Root Diseases of *Hevea Brasiliensis*, by W. J. Gallagher. C

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